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SLIDING DEVICE FOR TRANSMITTING TORQUE, WITH ROLLING BODIES  
AND SPRINGS FOR POSITIONING SAME  
[DISPOSITIF DE COULISSEMENT POUR TRANSMISSION D'UN COUPLE,  
A CORPS DE ROULEMENT ET RESSORTS DE LOCALISATION DE CES  
DERNIERS]

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This invention relates to a sliding device for transmitting torque, with rolling bodies and springs for positioning these bodies.

Many sliding systems that include rolling bodies intercalated between the sliding parts, and inside which these rolling bodies are kept in a fixed position on one of said parts, are known.

The goal of this invention is a sliding device inside which the rolling bodies can move in relation to the two sliding parts.

The device of the invention is composed of: a sleeve that is integrated into one of the sliding parts and that has longitudinal grooves on its interior; an end piece that is integral with or integrated into the other sliding part and equipped on its exterior with longitudinal grooves; rolling bodies (balls, rollers, or the like) placed inside said grooves between the sleeve and the end piece; of control springs that rest, on the one hand, on one of their ends on stops placed at the ends of the sleeve's working part and/or of the end piece and, on the other hand, on their other end, on the rolling bodies.

The rolling bodies may be arranged inside a cage, on the extreme edges of which the control springs rest.

The rolling bodies may remain free and their extreme elements may act directly as a resting place for the control springs.

There may be two control springs that surround the end piece on either side of the rolling bodies.

The control springs may form, on either side of the rolling bodies, a group of springs inserted into the grooves of the sleeve and of the end pieces. The grooves that accommodate these springs may be the ones that constitute the tracks for the rolling bodies or they may be grooves that are specially designed to accommodate them.

The stops at the ends of the working part of the sleeve and of the end piece become involved simultaneously when the device of the invention does not undergo traction or compression stresses; in other words, when it occupies its "middle" position. These stops only intervene alternatively when the device is compressed or is extended, with two stops then being acted upon, one belonging to the sleeve and the other to the end piece.

The device is described in greater detail below, with reference to the attached drawings, wherein:

Figure 1 shows a first embodiment of the device, seen in longitudinal cross section;

Figure 2 is a cross section along Line II-II of Figure 1;

Figure 3 is a cross section along Line III-III of Figure 1;

Figure 4 shows an embodiment variation, seen in longitudinal cross section;

Figure 5 is a cross section along Line V-V of Figure 4.

In the embodiment shown in figures 1 through 3 and cited as an example, the device includes, on the one hand, a sleeve 1 whose interior has longitudinal grooves 2 whose cross section is essentially hemi-circular and, on the other hand, an end piece 3 whose exterior has longitudinal grooves 4.

The sleeve 1 may be integral with or integrated into one of the sliding parts A and the end piece 3 may be integral with or integrated into the other part B of the sliding system; the two parts or only one of them may be put in movement by a translational movement along their respective axis.

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Between the two parts are inserted balls 5 or any other equivalent rolling bodies that can roll inside the

grooves 2 and 4. The balls 5 are, in this embodiment, imprisoned inside a cage 6 equipped with longitudinal slots, inside which the balls 5 are juxtaposed. The slots could also be replaced with circular holes, each of which accommodates a ball. Therefore, the balls can be encaged either in groups or by individual units.

At the two ends of the working part of the sleeve 1, slotted elastic rings 7 and 8 are placed, and onto the two ends of the working part of the end piece 3, slotted elastic rings 9 and 10 are attached. Between the rolling bodies -- that is, the balls 5 in this case, but which could be rollers, for example - and the rings 7 and 8, on the one hand, and the rings 9 and 10, on the other hand, springs 11 and 12, housed inside the grooves 2 and 4, are placed. These springs exert antagonistic force onto the cage 6, whose edges 6a and 6b have been folded back in order to provide better support to the springs.

The springs could be housed inside grooves other than the ones acting as a track for the balls 5. Moreover, the cage could be made up of several parts depending upon the desired applications for the device.

In the embodiment shown in figures 4 and 5, the device includes a sleeve 1' equipped with longitudinal grooves 2'

and an end piece 3' with longitudinal grooves 4' inside which the balls 5' are housed.

Onto the ends of the working part of the sleeve 1' are attached elastic rings 7' and 8' and onto the ends of the working part of the end piece 3', elastic rings 9' and 10'. These rings 7', 8', 9', and 10' support the two control springs 13 and 14, which exert their thrust directly onto the end balls 5', which are, in this variation, completely free inside the grooves 2' and 4'. Washers 15 and 16 may be placed at the opposite ends of the springs between the latter and the rings that support them.

Operation remains the same in both embodiments.

In both cases, the device includes intermediary rolling bodies, of a suitable shape, installed between a sleeve 1 or 1' and an end piece 3 or 3' and whose axial position is determined by the action of springs that rest either on the rolling bodies themselves, or by one or several attached parts such as a cage 6, on the one hand, and on stops that are created on the sleeve and on the end piece and that are composed of the elastic rings, on the other hand, such that the springs placed on either side of the rolling bodies always work in similar conditions for symmetrical sliding positions in relation to the median

position in which the two variations in figures 1 and 4 are shown.

It is in this position that the springs are the most relaxed; any displacement either extending or contracting the device leads to compression of the springs or of the groups of springs located on either side of the rolling bodies. If the springs placed on either side of the latter have the same flexion characteristics, equilibrium of all of the rolling bodies exists between two control springs.

Hence, contraction of the device leads to intervention by the stop ring 7, the edge 6a of the cage 6, the edge 6b of the same cage, and the stop ring 10 (or, in figures 4 and 5, the stop ring 7', the end ball 5'a, the end ball 5'b, and the stop ring 10') whereas extension of the device involves the stop rings 9 (or 9') and 8 (or 8').

Under these conditions, it is certain that the rolling bodies constantly occupy an appropriate relative position throughout the period of operation. Moreover, there is no need to fear untimely displacement of the rolling bodies when the device is no longer transmitting the engine torques for which it is intended to be used.

It is possible to join onto the device of the invention, as is shown by way of example in Figure 4, a spring 17 for making an assembly that produces an oriented-



value axial stress; in this case, this involves permanently extending the device under the action of said spring.

Of course, the device described above can accommodate shape and detail modifications based on the applications to be made for it without exceeding the scope of the invention.

#### SUMMARY

The goal of the invention is:

1. A sliding device for transmitting torque with rolling bodies and springs for positioning the latter, made up of: a sleeve that is integrated into one of the sliding parts and equipped with longitudinal grooves on its interior; an end piece that is integral with or integrated into the other sliding part and whose exterior is equipped with longitudinal grooves; of rolling bodies (balls, rollers, or other) placed inside said grooves between the sleeve and the end piece; of control springs that rest, on the one hand, on one of their ends of stops at the ends of the working part of the sleeve and/or of the end piece and, on the other hand, by their other end, on the rolling bodies.

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2. In this type of device, the following complementary features considered in isolation or in combination:

- a. The rolling bodies are installed inside a cage on the end edges of which the control springs rest;
- b. The rolling bodies remain free and their end elements directly support the control springs;
- c. There are two control springs and they surround the end piece on either side of the rolling bodies;
- d. The control springs form, on either side of the rolling bodies, a group of springs inserted inside the grooves of the sleeve and of the end piece;
- e. The grooves accommodating the springs are the ones that make up the tracks for the rolling bodies;
- f. The grooves accommodating the springs are specially made in the sleeve and the end piece in order to accommodate them;
- g. The device is balanced by the existence of similar springs placed on either side of the rolling bodies;
- h. If the device should not be balanced or if it must offer a preferred axial action, one may either place, on either side of the rolling bodies, springs that have different flexibility characteristics, or add a traditional control spring onto the exterior of the device;
- i. In addition to the rolling bodies, compression or extension stresses lead to the intervention of two stops,

one of which belongs to the sleeve and the other of which belongs to the end piece.

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Figure 1

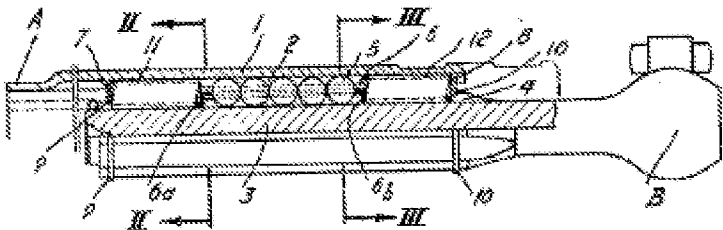


Figure 2

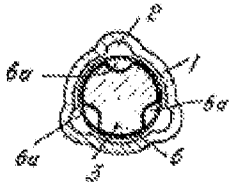


Figure 3

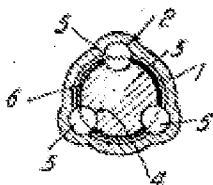


Figure 4

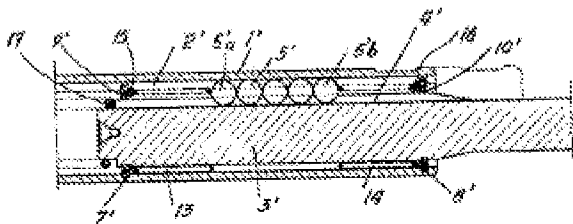


Figure 5

